Course Code: 23HS0834 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR

(AUTONOMOUS)

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Numerical Methods & Transform Techniques (23HS0834)

Year & Sem: II-B.Tech & I-Sem **Course & Branch**: B.Tech – ME **Regulation:** R23

UNIT –I

SOLUTION OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS

1	a) Find the root of the equation $x^2 - 5 = 0$ by using Bisection method.	[L1][CO1]	**[2M]**
	b) Write the formula to find the root of an equation by Regula Falsi method.	[L1][CO1]	**[2M]**
	c) Write the formula to find the root of an equation by Newton Raphson's method.	[L1][CO1]	**[2M]**
	d) Compare Jacoby and Gauss Seidel methods.	[L5][CO1]	**[2M]**
	e) Solve by Jacoby method [Only two iterations] $\boldsymbol{x + y = 3\,;3x - 2y = 4}$.	[L3][CO1]	**[2M]**
2	a) Find a positive root of the equation $\boldsymbol{x^3 - x - 1 = 0}$ by Bisection method.	[L1][CO1]	**[5M]**
	b) Find out the square root of 25 given $x_0 = 2.0,\ x_1 = 7.0$ using Bisection method.	[L1][CO1]	**[5M]**
3	a) Find a positive root of the equation $x^4 - x - 10 = 0$ by iteration method.	[L1][CO1]	**[5M]**
	b) Solve $x^3 - 2x - 5 = 0$ for a positive root by iteration method.	[L3][CO1]	**[5M]**
4	Find the root of the equation $x\,e^x = 2$ using Regula-falsi method.	[L1][CO1]	**[10M]**
5	Find the root of the equation $x^3 - x - 4 = 0$ using False position method.	[L1][CO1]	**[10M]**
6	Find a real root of the equation $x\tan x + 1 = 0$ using Newton – Raphson method.	[L1][CO1]	**[10M]**
7	Find a real root of the equation $e^x \sin x = 1$ using Newton – Raphson method.	[L1][CO1]	**[10M]**
8	Solve the following system of equations by Jacobi method $27\boldsymbol{x + 6y - z = 85\,; x + y + 54z = 110\,; 6x + 15y + 2z = 72}$.	[L3][CO1]	**[10M]**
9	Solve the following system of equations by Jacobi method $2\boldsymbol{x - 3y + 20z = 25\,; 20x + y - 2z = 17\,; 3x + 20y - z = -18}$.	[L3][CO1]	**[10M]**
10	Apply Gauss Siedel iteration method to solve equations $\boldsymbol{20x + y - 2z = 17\,; 3x + 20y - z = -18; 2x - 3y + 20z = 25}$.	[L3][CO1]	**[10M]**
11	Solve the following system of equations by Gauss-Siedel method $4\boldsymbol{x + 2y + z = 14\,; x + 5y - z = 10\,; x + y + 8z = 20}$.	[L3][CO1]	**[10M]**

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UNIT –II

INTERPOLATION

1

a) Write Newton's forward interpolation formulae. [L1][CO2] **[2M]**

b) Construct a forward difference table for the function $y = x^2$ for x = 0, 1, 2, 3. [L3][CO2] **[2M]**

c) Write Lagrange's interpolation formulae. [L1][CO2] **[2M]**

d) State the two normal equation used in fitting a straight line. [L1][CO2] **[2M]**

e) Write the normal equations used in fitting a second degree polynomial. [L1][CO2] **[2M]**

2

a) Using Newton's forward interpolation formula and the given table of values [L3][CO2] **[5M]**

x	1	1.4	1.8	2.2
f(x)	3.49	4.82	5.96	6.5

Obtain the value of *f(x)* when *x=1.6*.

b) Applying Newton's forward interpolation formula, compute the value of $\sqrt{5.5}$ given that $\sqrt{5} = 2.236$; $\sqrt{6} = 2.449$; $\sqrt{7} = 2.646$; $\sqrt{8} = 2.828$. [L3][CO2] **[5M]**

3

From the following table values of x and *y=tan x*. Interpolate the values of y when *x=0.12* and *x=0.28*. [L5][CO2] **[10M]**

x	0.10	0.15	0.20	0.25	0.30
y	0.1003	0.1511	0.2027	0.2553	0.3093

4

a) Using Newton's forward interpolation formula and the given table of values [L3][CO2] **[5M]**

x	1.1	1.3	1.5	1.7	1.9
f(x)	0.21	0.69	1.25	1.89	2.61

Obtain the value of *f(x)* when *x=1.4*.

b) Use Newton's backward interpolation formula to find f(32) given f(25)=0.2707, f(30)=0.3027, f(35)=0.3386, f(40)=0.3794. [L3][CO2] **[5M]**

5

Using Lagrange's interpolation formula, find the value of y(10) from the following table: [L3][CO2] **[10M]**

x	5	6	9	11
y	12	13	14	16

6

The values of a function f(x) are given below for certain values of x. Find the values of f(2) using Lagrange's interpolation formula. [L1][CO2] **[10M]**

x	0	1	3	4
y	5	6	50	105

7

By method of least squares fit a straight line to the following data ; [L3][CO2] **[10M]**

X	1	2	3	4	5
y	14	27	40	55	68

8

Fit a straight line $y = ax + b$ for the following data [L3][CO2] **[10M]**

X	6	7	7	8	8	8	9	9	10
Y	5	5	4	5	4	3	4	3	3

9	Fit a second degree polynomial to the following data by method of least square	[L3][CO2]	**[10M]**

X	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

10	Obtain a second degree polynomial to the data by method of least square	[L3][CO2]	**[10M]**

X	1	2	3	4	5
Y	10	12	8	10	14

11	Find the curve of best fit of the type $y = ae^{bx}$ to the following data by method of least squares	[L1][CO2]	**[10M]**

X	1	5	7	9	12
Y	10	15	12	15	21

UNIT –III

SOLUTION OF INITIAL VALUE PROBLEMS TO ORDINARY DIFFERENTIAL EQUATIONS

1	a) Write Taylor's formula for $\boldsymbol{y(x_1)}$ to solve $\boldsymbol{y' = f(x,y)}$ ***with*** $\boldsymbol{y(x_0) = y_0}$.	[L1][CO3]	**[2M]**
	b) State Euler formula to solve $y' = f(x,y),\ y(x_0) = y_0\ at\ x = x_0 + h$.	[L1][CO3]	**[2M]**
	c) Find $y^{(1)}(x)$, by Picard's method, given that $\frac{dy}{dx} = 1 + xy\ ;\ y(0) = 1$.	[L1][CO3]	**[2M]**
	d) If $\frac{dy}{dx} = y - x\ ; y(0) = 2, h = 0.2$ then Find the value of k_1 in R–K method of fourth order.	[L1][CO4]	**[2M]**
	e) Write the formula for Runge – Kutta method of fourth order.	[L1][CO4]	**[2M]**
2	Tabulate $y(0.1), y(0.2)\ and\ y(0.3)$ using Taylor's series method given that $y^1 = y^2 + x$ and $y(0) = 1$	[L3][CO3]	**[10M]**
3	Solve $y^1 = x + y$, given $y\ (1) = 0$ find $y(1.1)\ and\ y(1.2)$ by Taylor's series method.	[L3][CO3]	**[10M]**
4	Find an approximate value of $y\ for\ x = 0.1$ by Picard's method, given that $\frac{dy}{dx} = x + y\ , y(1) = 1$.	[L1][CO3]	**[10M]**
5	Find the values of $\boldsymbol{y(0.1)}$ ***and*** $\boldsymbol{y(0.2)}$ by Picard's method given that $\mathbf{y^1 = y - x^2}\ , \mathbf{y(0) = 1}$.	[L1][CO3]	**[10M]**
6	Solve by Euler's method $\frac{dy}{dx} = \frac{2y}{x}$ given y(1)=2 and find $y(2)\ \ and\ y(3)$.	[L3][CO4]	**[10M]**
7	Solve by Euler's method $y' = y^2 + x\ ; y(0) = 1$.and find y(0.1) and y(0.2)	[L3][CO4]	**[10M]**
8	Using modified Euler's method find $y(0.2) and\ y(0.4),\ given\ y^1 = y + e^x$, $y(0) = 0$	[L3][CO4]	**[10M]**
9	Using Runge – Kutta method of fourth order, compute $y(0.2)$ from $y^1 = xy$; $y(0) = 1,$ taking $h = 0.2$	[L3][CO4]	**[10M]**
10	Using Runge – Kutta method of fourth order, solve $\boldsymbol{\frac{dy}{dx} = x^2 - y, y(0) = 1.}$ Find $\boldsymbol{(0.1)}$ ***and*** $\boldsymbol{y(0.2)}$.	[L3][CO4]	**[10M]**

11	Using Runge – Kutta method of fourth order, find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} = x + y, y(0) = 1$.	[L3][CO4]	**[10M]**

UNIT –IV
LAPLACE TRANSFORMS

1	a) What is the Linear Property of Laplace Transform	[L1][CO5]	**[2M]**
	b) State First Shifting Theorem	[L1][CO5]	**[2M]**
	c) State Change of Scale Property	[L1][CO5]	**[2M]**
	d) Define Unit Step Function	[L1][CO5]	**[2M]**
	e) State Convolution Theorem	[L1][CO5]	**[2M]**
2	a) Find the Laplace transform of $\boldsymbol{f(t) = e^{3t} - 2e^{-2t} + sin2t + cos3t + sinh3t - 2cosh4t + 9}$.	[L3][CO5]	**[5M]**
	b) Find the Laplace transform of $\boldsymbol{f(t) = cosh\ at\ sin\ bt}$	[L3][CO5]	**[5M]**
3	a) Find the Laplace transform of $\boldsymbol{f(t) = \left(\sqrt{t} + \frac{1}{\sqrt{t}}\right)^3}$.	[L3][CO5]	**[5M]**
	b) Find the Laplace transform of $\boldsymbol{e^{4t} sin2t\ cost}$.	[L3][CO5]	**[5M]**
4	a) Find the Laplace transform of $\boldsymbol{f(t) = cost.cos2t.cos3t}$	[L3][CO5]	**[5M]**
	b) Find $\boldsymbol{L\{e^{-3t} sinh3t\}}$	[L3][CO5]	**[5M]**
5	a) Find the Laplace transform of $\boldsymbol{t^2 e^{2t} sin\ 3\ t}$.	[L3][CO5]	**[5M]**
	b) Find the Laplace transform of $\int_0^t \frac{sin\ \ t}{t} dt$	[L3][CO5]	**[5M]**
6	a) Find the Laplace transform of $\int_0^t e^{-t} cos\ t\ dt$.	[L3][CO5]	**[5M]**
	b) Find the Laplace transform of$e^{-4t} \int_0^t \frac{sin\ 3t}{t} dt$.	[L3][CO5]	**[5M]**
7	a) Show that$\int_0^\infty t^2\ e^{-4t}.sin\ 2\ tdt = \frac{11}{500}$, Using Laplace transform.	[L1][CO5]	**[5M]**
	b) Using Laplace transform, evaluate$\int_0^\infty \frac{cos\ at - cos\ bt}{t} dt$.	[L3][CO5]	**[5M]**
8	a) Find$L^{-1}\left\{\frac{3s-2}{s^2-4s+20}\right\}$ by using first shifting theorem.	[L3][CO5]	**[5M]**
	b) Find $L^{-1}\{\cot^{-1} s\}$	[L3][CO5]	**[5M]**
9	a) Find$L^{-1}\left\{\frac{1}{(s^2+5^2)^2}\right\}$, using Convolution theorem.	[L3][CO5]	**[5M]**
	b) Find $L^{-1}\left\{\frac{s^2}{(s^2+4)\ (s^2+25)}\right\}$, using Convolution theorem.	[L3][CO5]	**[5M]**
10	a) Find the Inverse Laplace transform of$\frac{1}{s(s^2+a^2)}$	[L3][CO5]	**[5M]**
	b) Find $L^{-1}\left\{\frac{s-2}{s^2+5s+6}\right\}$	[L3][CO5]	**[5M]**
11	a) Using Convolution theorem, Find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$	[L3][CO5]	**[5M]**

	b) Using Convolution theorem, Find $L^{-1}\left\{\frac{1}{(s+a)(s+b)}\right\}$	[L3][CO5]	**[5M]**

UNIT –V
FOURIER TRANSFORMS

1	a) Write the conditions for Fourier Series Expansion	[L1][CO6]	**[2M]**
	b) Write the Euler's formula for Fourier Series	[L1][CO6]	**[2M]**
	c) State Fourier integral theorem	[L1][CO6]	**[2M]**
	d) State the shifting property of Fourier Transform	[L1][CO6]	**[2M]**
	e) Write the formula for Fourier cosine transform	[L1][CO6]	**[2M]**
2	Obtain the Fourier series expansion of $f(x) = x^2$ in $0 < x < 2\pi$	[L3][CO6]	**[10M]**
3	Expand $f(x) = \|x\|$ as a fourier series in the interval $(-2,2)$.	[L3][CO6]	**[10M]**
4	If $f(x) = \|\sin x\|$, expand f(x) as a Fourier series in the interval $(-\pi, \pi)$	[L3][CO6]	**[10M]**
5	Find the half range cosine series expansion of $f(x) = x(2 - x)$ in $0 \le x \le 2$.	[L1][CO6]	**[10M]**
6	Find the half range sine series for $f(x) = x(\pi - x)$ in the interval $0 \le x \le \pi$ and deduce that $\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} - - - - -= \frac{\pi^3}{32}$.	[L1][CO6]	**[10M]**
7	Using Fourier integral theorem, Show that $e^{-ax} - e^{-bx} = \frac{2(b^2-a^2)}{\pi}\int_0^\infty \frac{\lambda \sin\lambda x \, d\lambda}{(\lambda^2+a^2)(\lambda^2+b^2)}$, $a, b > 0$	[L3][CO6]	**[10M]**
8	Find the Fourier transform of $f(x) = \begin{cases} 0; & -\infty < x < \alpha \\ x, & \alpha < x < \beta \\ 0, & x > \beta \end{cases}$	[L1][CO6]	**[10M]**
9	Find the Finite Fourier sine transform of f(x)=$2x$, where $0 < x < 2\pi$	[L1][CO6]	**[10M]**
10	Find the Fourier sine and cosine transforms of f(x)=$e^{-ax}, a > 0$and hence deduce the integrals (i) $\int_0^\infty \frac{p \sin px}{a^2+p^2} dp$ (ii) $\int_0^\infty \frac{\cos px}{a^2+p^2} dp$	[L1][CO6]	**[10M]**
11	a) Prove that F_c{ x f(x) } = $\frac{d}{dp}[F_s(p)]$	[L5][CO6]	**[5M]**
	b) Prove that F_s{ x f(x) } = $-\frac{d}{dp}[F_c(p)]$	[L5][CO6]	**[5M]**

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